REMARKS

This Amendment and Response are made in reply to the Final Office Action dated November 5, 2008, in which:

Claims 1-11 were rejected under 35 USC §101 as directed to non-statutory subject matter;

Claims 1-9 were rejected under 35 USC § 103(a) as obvious over Stoecker (Industrial Refrigeration Handbook) in view of Cengel (Thermodynamics);

Claims 10, 12, and 16 were rejected under 35 USC § 103(a) as obvious over Stoecker in view of Cengel and further in view of Seem (U.S. Patent No. 6,223,544);

Claims 11, 13-15, and 17 were rejected under 35 USC § 103(a) as obvious over Stoecker in view of Cengel and Seem, and further in view of Parlos (U.S. Patent No. 6,590,362); and

Claim 18 was rejected under 35 USC § 103(a) as obvious over Stoecker in view of Cengel and further in view of Knudsen (U.S. Pub. No. 2003/0156999).

Applicants respectfully traverse the rejections below. Claim 1 is canceled; claims 2-18 are amended; claims 19 and 20 are added. Support for added claims 19 and 20 is found at least in equation (3) and pages 10-13 of the Specification as originally filed. No new matter is added.

Applicants respectfully submit that the present Office Action is the first Office Action issued after entry of Applicants' Request for Continued Examination. Although the present Office Action was indicated as Final on the Office Action Summary, Examiner presented no reasons in support of finality. Accordingly, Applicants respectfully request that finality of the present Office Action be withdrawn.

Claim 1 and dependent claims 2-11 were rejected under 35 USC § 101 as directed to non-statutory subject matter. Amended claims 2-11 depend from amended claim 12, which recites a flash gas detection device. Applicants respectfully request that the rejections of amended claims 2-11 under 35 USC § 101 be withdrawn.

Claims 1-9 were rejected under 35 USC § 103(a) as obvious over Stoecker (Industrial Refrigeration Handbook) in view of Cengel (Thermodynamics). Claims 10, 12, and 16 were rejected under 35 USC § 103(a) as obvious over Stoecker in view of Cengel and further in view of Seem (U.S. Patent No. 6,223,544). An obviousness rejection is improper unless supported by a clearly stated *prima facie* case of obviousness. A *prima facie* case of obviousness under 35 USC §103(a) is established only if the prior art would have taught or suggested the claimed subject matter "as a whole" to a person of ordinary skill in the art, at the time of the claimed invention. In particular, when an element of the claimed invention is not taught or suggested by *any* of the references in a proposed combination, then the combination of the deficient references likewise fails to teach or suggest the claimed invention.

Amended claim 12 recites a flash gas detection device for a vapour-compression refrigeration or heat pump system comprising a compressor, a condenser, an expansion device, and an evaporator interconnected by conduits providing a flow path for a refrigerant, wherein the device comprises: means for determining a first rate of heat flow of a heat exchange fluid flow across a heat exchanger of the system and a second rate of heat flow of the refrigerant across the heat exchanger, and using the rates of heat flow for establishing an energy balance from which a residual for monitoring the refrigerant flow is derived; and evaluation means for evaluating the refrigerant mass flow, and providing an output signal indicating the presence or absence of flash gas, based on the residual, wherein the means for determining the second rate of heat flow uses inputs from means for sensing absolute refrigerant pressure before and after the expansion device, means for establishing an opening passage or opening period of the expansion device, and means for storing a value representing a flow characteristic of the expansion device, without requiring measurement of refrigerant temperature at expansion device entry and exit.

Stoecker does not teach or suggest evaluation means for evaluating a refrigerant mass flow, and providing an output signal indicating the presence or absence of flash gas, based on a residual derived from an energy balance established using a refrigerant rate of heat flow and a heat exchange fluid rate of

heat flow *across a heat exchanger*, as recited by amended claim 12. Instead, Stoecker uses a level control valve and a separating vessel to separate flash gas from liquid refrigerant, and determines the amount of flash gas exiting the level control valve using a mass and energy balance *about the separating vessel*. (See Stoecker, page 67). Stoecker's separating vessel does *not* teach or suggest a heat exchanger, at least because Stoecker's Figure 3.3 clearly shows that refrigerant entering the separating vessel ("7"), vapor leaving the separating vessel ("3"), and refrigerant leaving the separating vessel ("8") all are at a common saturation temperature.

Stoecker also *teaches away* from determining a rate of refrigerant heat flow, without requiring measurement of refrigerant temperature at expansion device entry and exit; or means for determining a rate of refrigerant heat flow, using inputs from means for sensing absolute refrigerant pressure before and after an expansion device. At most, Stoecker teaches assuming a 200 kW rate of refrigerant heat flow, establishing refrigerant temperatures at expansion device entry and exit, and deriving a mass flow rate of flash gas from the assumed rate of heat flow and the established refrigerant temperatures. (See Stoecker, pages 65-68). Stoecker's approach of *assuming* a 200 kW rate of refrigerant heat flow does not teach or suggest *determining* a rate of refrigerant heat flow. If anything, Stoecker's equations deriving a mass flow rate of flash gas from an assumed rate of refrigerant heat flow and established refrigerant temperatures *teach away* from determining a rate of refrigerant heat flow *without requiring* measurement of refrigerant *temperature* at expansion device entry and exit. Stocker's methodology also *teaches away* from means for determining a rate of refrigerant heat flow, using inputs from means for sensing absolute refrigerant pressure before and after an expansion device.

Thus, Stoecker fails to teach or suggest the recitations of amended claim 12 as a whole.

Cengel fails to supply the deficiencies of Stoecker with reference to amended claim 12, since Cengel teaches nothing regarding flash gas or detection thereof. Cengel also *teaches away* from determining a rate of refrigerant heat flow, using inputs from means for sensing absolute refrigerant pressure before and after an expansion device, because Cengel uses condenser temperatures and

pressure and an *assumed* refrigerant mass flow rate to determine a mass flow rate of water. Cengel also *teaches away* from determining a rate of refrigerant heat flow, without requiring measurement of refrigerant temperature at expansion device entry and exit, because Cengel's equations *require* refrigerant temperature leaving a condenser, which one of ordinary skill would recognize as equivalent to refrigerant temperature at an expansion device entry.

The combination of Stoecker and Cengel also fails to teach or suggest determining a rate of refrigerant heat flow, without requiring measurement of refrigerant temperature at expansion device entry and exit, as recited by amended claim 12.

Seem fails to supply the deficiencies of Stoecker and Cengel, since Seem also teaches nothing regarding flash gas or detection thereof. Seem also fails to teach or suggest determining a rate of refrigerant heat flow, without requiring measurement of refrigerant temperature at expansion device entry and exit; or determining a rate of refrigerant heat flow, using inputs from means for sensing absolute refrigerant pressure before and after an expansion device, as recited by amended claim 12. If anything, Seem *teaches away* from the recitations of amended claim 12, since all of Seem's equations rely on *measured temperatures*.

Additionally, Stoecker teaches an energy balance across a separating vessel in which no heat exchange occurs. Examiner proposes modifying Stoecker's energy balance, according to Seem's residual equations, in order to detect presence or absence of flash gas. However, Examiner concedes "Seem teaches that there is *no predictable relationship* … when there is no heating or cooling, and thus no heat flux" (see Office Action, page 9) (emphasis added) which is the exact situation presented in Stoecker's separating vessel. Thus, Seem *teaches away* from modifying Stoecker's separating vessel energy balance to obtain a residual for detecting flash gas.

Since the combination of Stoecker, Cengel, and Seem does not teach or suggest determining a rate of refrigerant heat flow, without requiring measurement of refrigerant temperature at expansion device entry and exit; or determining a rate of refrigerant heat flow, using inputs from means for sensing absolute refrigerant pressure before and after an expansion device, as recited by

amended claim 12, the rejection of amended claim 12 over Stoecker, in view of Cengel and Seem, is improper under 35 USC § 103(a), and should be withdrawn.

At least because amended claims 2-10 and 16 depend from claim 12, the rejections of these dependent claims over Stoecker, Cengel, and Seem also are improper under 35 USC § 103(a), and should be withdrawn.

Additionally, amended claim 8 depends from amended claim 12 and further recites wherein the means for determining the second rate of heat flow establishes the refrigerant mass flow based on a flow characteristic of the expansion device, and the expansion device opening passage and/or opening period, and an absolute pressure before and after the expansion device, without measuring subcooling of the refrigerant at the expansion device entry.

Examiner concedes "Stoecker teaches that the flash gas develops as the expansion proceeds." (See Office Action, page 4). Thus, Stoecker teaches one of ordinary skill that refrigerant in an expansion device will have changing thermodynamic properties, according to vapor quality of the refrigerant, which in turn depends upon subcooling of the refrigerant at expansion device entry. Thus, Stoecker *teaches away* from establishing refrigerant mass flow based on a flow characteristic of an expansion device, *without measuring subcooling* of the refrigerant at the expansion device entry. Cengel and Seem teach nothing regarding establishment of refrigerant mass flow based on a flow characteristic of an expansion device. Even the combination of Stoecker, Cengel, and Seem fails to teach or suggest establishing refrigerant mass flow based on a flow characteristic of an expansion device, *without measuring subcooling* of the refrigerant at the expansion device entry, as recited by amended claim 8.

For at least this additional reason, the rejection of amended claim 8 over Stoecker, Cengel, and Seem is improper under 35 USC § 103(a), and should be withdrawn.

Claims 11, 13-15, and 17 were rejected under 35 USC § 103(a) as obvious over Stoecker in view of Cengel and Seem, and further in view of Parlos (U.S. Patent No. 6,590,362). Amended claims 11, 13-15, and 17 depend from amended claim 12.

With reference to amended claim 12, the deficiencies of Stoecker, Cengel, and Seem already have been discussed. Parlos fails to supply the aforementioned deficiencies. In particular, Parlos is directed to early detection of incipient faults in electric motors. Parlos teaches nothing regarding a flash gas detecting device, a heat exchanger, a heat exchange fluid, or a refrigerant. Parlos also fails to teach or suggest determining a rate of refrigerant heat flow, without requiring measurement of refrigerant temperature at expansion device entry and exit; or determining a rate of refrigerant heat flow, using inputs from means for sensing absolute refrigerant pressure before and after an expansion device, as recited by amended claim 12. Even the combination of Stoecker, Cengel, Seem, and Parlos still fails to teach or suggest at least these recitations of amended claim 12.

At least because the combination of Stoecker, Cengel, Seem, and Parlos fails to teach or suggest the recitations of amended claim 12 as a whole, the rejections of dependent claims 11, 13-15, and 17 are improper under 35 USC § 103(a), and should be withdrawn.

Additionally, amended claim 11 recites the evaluation means evaluates the refrigerant mass flow by means of a fault indicator provided according to a recited formula.

Parlos does not teach or suggest the formula recited by amended claim 11. Similarly, Seem fails to teach or suggest the formula recited by amended claim 11. Stoecker and Cengel teach nothing regarding fault indicators. Even the combination of Stoecker, Cengel, Seem, and Parlos fails to teach or suggest the fault indicator formula recited by amended claim 11.

For at least this additional reason, the rejection of amended claim 11 over Stoecker, Cengel, Seem, and Parlos is improper under 35 USC § 103(a), and should be withdrawn. At least because amended claim 14 depends from amended claim 11, the rejection of amended claim 14 over Stoecker, Cengel, Seem, and Parlos also is improper under 35 USC § 103(a), and should be withdrawn.

Additionally, amended claim 15 recites the means for determining the second rate of heat flow establishes the refrigerant heat flow according to a recited equation using measured values only of condenser refrigerant pressure,

evaporator exit pressure, and expansion device opening period or opening passage.

As discussed above, Stoecker teaches using an assumed refrigerant heat flow rate and established refrigerant temperatures to determine a mass flow of flash gas. Cengel teaches using an assumed refrigerant mass flow rate and condenser pressure and temperatures to determine a mass flow rate of water. Even the combination of Stoecker and Cengel fails to teach or suggest establishing refrigerant heat flow based on condenser refrigerant pressure, evaporator exit pressure, and expansion device opening period or opening passage. As discussed above, Seem and Parlos teach nothing regarding a flash gas detection device. The combination of Seem and Parlos also fails to teach or suggest establishing refrigerant heat flow based on condenser refrigerant pressure, evaporator exit pressure, and expansion device opening period or opening passage. Even the combination of Stoecker, Cengel, Seem, and Parlos fails to teach or suggest the recitations of amended claim 15 as a whole.

For at least this additional reason, the rejection of amended claim 15 over Stoecker, Cengel, Seem, and Parlos is improper under 35 USC § 103(a), and should be withdrawn.

Claim 18 was rejected under 35 USC § 103(a) as obvious over Stoecker in view of Cengel and further in view of Knudsen (U.S. Pub. No. 2003/0156999).

Amended claim 18 depends from amended claim 12. With reference to amended claim 12, the deficiencies of Stoecker and Cengel have been discussed above. Knudsen fails to supply the deficiencies of Stoecker and Cengel since Knudsen teaches nothing regarding a flash gas detection device, a refrigeration or heat pump system, means for determining a refrigerant heat flow rate, or evaluation means for evaluating a refrigerant mass flow. Even the combination of Stoecker, Cengel, and Knudsen fails to teach or suggest the recitations of amended claim 12 as a whole.

At least because amended claim 18 depends from amended claim 12, the rejection of amended claim 18 over Stoecker, Cengel, and Knudsen is improper under 35 USC § 103(a), and should be withdrawn.

Applicants respectfully submit that none of the cited references, nor any combination thereof, teaches or suggests means for determining a rate of heat flow that determines a refrigerant mass flow according to the equation:

$$\dot{m}_{ref} = k_{\exp} \cdot \left(P_{con} - P_{ref,out} \right) \cdot OP \ ,$$

without requiring measurement of refrigerant temperature at an expansion device entry and exit, as recited by claim 19. Additionally, Applicants respectfully submit that none of the cited references, nor any combination thereof, teaches or suggests evaluation means that provide an output signal indicating the presence of flash gas in case the time average of a residual is less than zero, as recited by claim 20. Applicants respectfully submit that added claims 19 and 20 are patentable for at least these reasons, in addition to the reasons set forth with reference to amended claim 12.

As Applicants have overcome or traversed each and every rejection raised by Examiner, Applicants respectfully request that Examiner withdraw finality of the present Office Action, withdraw the present rejections, and pass to issue claims 2-20.

Applicants hereby petition for a one (1) month extension of time to respond to the present Office Action. Attorneys for Applicants hereby authorize the Commissioner to charge the one (1) month extension fee of $130.00 to the Deposit Account 13-0235.

Applicants believe that no additional fees are due in connection with this Amendment and Response. If such additional fees are deemed necessary, Attorneys for Applicants hereby authorize the Commissioner to deduct such fees from our Deposit Account 13-0235.

Respectfully submitted,

By /Marina F. Cunningham/
Marina F. Cunningham
Registration No. 38,419
Attorney for Applicants

Customer No. 35301
McCORMICK, PAULDING & HUBER LLP
CityPlace II, 185 Asylum Street
Hartford, CT 06103-3402
(860) 549-5290